

Regular Languages, Pumping Lemma and existence of an FSA for a Language

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Continued -

Q. Find an automaton which accepts a string from L where L on $\Sigma = \{0,1\}$ where $\#0 = \#1$.

Let the automaton is finite and size N . A string that is accepted with no repetition of state must be of less than N length. Any longer string must have a repeated state.

$0N1N$ must be accepted. Suppose it is accepted. Then there must be a repetition of states in the first N characters. Suppose $r_i = r_j$. Then 0_i takes it to r_i and 0_{j-i} then takes it back to r_i . If we add $(0_{j-i})^k$ after 0_i , the resulting string will also be accepted by the automaton. But this string has more 0s than 1s. Hence \nexists a finite automaton.

Proposition

Regular Language A language is said to be a regular if there exists a deterministic FSA, that recognizes it.

Pumping Lemma

If L is a regular language, then \exists a natural number N called the pumping length such that if w is a string in L (i.e. $w \in L$) & $|w| \geq N$, then we can write $w=xyz$ such that

1. y is not empty
2. $|xy| \leq N$
3. xy^iz also belongs to $L \forall i=0,1,2,3\dots$

L is a set of strings over $\{0,1\}$ st the number of 0s exceeds the number of 1s. Not regular. Pumping lemma on $1N0N+1$ proves it.